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Abstract

OPERATIONAL EXPERIENCE ON THE 2ND CHARGE FOR THE HALDEN BOILING HEAVY WATER REACTOR

by

E. Jamne, J.A. Firing, M. Øvreeide and T. Wullum[+)]

Institutt for Atomenergi

OECD Halden Reactor Project

Halden, Norway

After termination of the 1st fuel charge operation in April 1961 the Halden Boiling Heavy Water Reactor was extensively modified for the 2nd charge operation. The reactor was taken critical in March 1962. After series of low power experiments, the initial approach to power was made in October 1962. Up to the end of 1963 the plant has been operated for experimental purposes on variable power levels up to the design power (20 M W). Most of this operation has been at 230°C or 28.5 ato reactor pressure.

Operation has been interrupted at intervals due to changes in the experimental set up and partly due to maintenance and modification. As could be expected in an experimental operation of this kind, involving so much experimental equipment, there has been a number of automatic shut down actions. The reactor has been totally 6800 hrs on pressure, mainly 28.5 ato and the integrated power at the end of 1963 was 1340 M W d corresponding to 950 M W d/ton UO_2.

The heavy water has degraded from 99.74 to 99.68% D_2O, and the average D_2O losses in the period between the inventory checks (performed during shut down and at low temperature) have ranged from 100 g/hr to 700 g/hr. Two incidents have resulted in a loss of about 300 kg D_2O. Sampling of the tritium content in moisture samples in the containment ventilation system has gradually developed to be a valuable tool for checking the daily D_2O losses. Tritium sampling of the closed secondary system water has shown no measurable leak-over of D^2O in the heat exchangers.

One fuel element failure has taken place resulting in fission product release. The I 131 content in the D_2O went up a factor 300 above the initial background which was about 10^{-6} μC/cc, but is back to normal after removal of the failed element.

The main flange connection for the reactor vessel has not been touched since installation in 1958, and no measureable leakages have been observed in the aluminium gaskets. Only a smaller fraction of the D_2O losses originates from the 335 seals in the top lid. 140 fuel positions seals have been opened and closed since the high temperature operation started. There has been some equipment failures, however, most of these have in general been of such a nature that they did not cause serious delays. Modification of the gas bleed off from one of the steam transformers has been necessary due to accumulation of radiolytic gases. Tests have proved that the radiolytic gas accumulation in the control station thimbles is not serious from an explosion point of view. This has resulted in that gas bleed off from the control stations could be avoided.

All operations are remotely controlled from the control room, which is located 150 m from the reactor hall. Since the shielding arrangement for the reactor does not permit access to the reactor hall during operation, the instrumentation of the reactor plant is rather extensive. The control of the reactor and plant has caused no significant difficulties. The reactor proved, however, to be more sensitive to load changes than anticipated, as a sudden increase in steam load outtake initiated flash boiling in the moderator.

The activity levels in the reactor hall did not raise any significant operational or maintenance problems. The highest closed contact dose rate measured 15 min. after shut down from 20 MW was 500 mr/hr (primary subcooler). The tritium activity in the D_2O increased to 120 μC/cc during the period.

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